

# Supplement to the Rutaceae in Peninsular Malaysia

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with account of *Melicope*

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## Abstract

Since the publication of the Rutaceae in the "Tree Flora of Malaya" (vol.1,1972), there have been a number of changes both bibliographic and taxonomic which ought to be accommodated in this account. The genus *Terminthodia* has been subsumed within *Tetractomia*; a new genus *Maclurodendron* has been established to include some species formerly placed in *Acronychia*; and *Tetradium* has been revived to hold certain species of *Euodia*. The remaining species of *Euodia* are now believed to be most correctly placed in *Melicope*. They are herein revised by T.G. Hartley. His account shows that *Melicope* is represented in Peninsular Malaysia by 10 species. Among these, *M. corneri* T. Hartley is proposed as a new species, *M. pahangensis* T.Hartley as a new name, and *M. pachyphylla* (King) T. Hartley and *M. macrocarpa* (King) T. Hartley as new combinations. In the Aurantioideae, there are now improved treatments of *Glycosmis* and *Citrus*, and the plant referred to as "Citrus sp. A" in the 1972 treatment was subsequently described as a new species, *C.halimii*. Some controversial matters such as the discrimination of certain genera and species are discussed herein. Finally the key to genera, which was imperfect, has been reworked and corrected. This account thus summarizes these details and presents, where useful, a new treatment to substitute for the old; it should be used in conjunction with the 1972 treatment. To facilitate use, the keys, generic, and specific accounts are set out here in the same form as in that volume.

## ANNOTATED KEY TO GENERA OF MALAYAN RUTACEAE

(Based chiefly on vegetative characters)

1. Woody climbers, never trees or erect shrubs; stems with recurved or hooklike spines ..... 2
1. Trees or erect shrubs, not climbers ..... 4
2. Leaves simple, shortly stalked; flowers solitary or clustered in axils, with 4 or 5 petals; fruits globose to obovoid, sometimes lobed, smooth to rough, lacking pulp-vesicles; seeds few ..... (some) *Paramignya*
2. Leaves compound, pinnate or trifoliolate (sometimes unifoliolate in juveniles) ..... 3
3. Leaves with 3-9 leaflets; twigs and leaf-stalks prickly; fruits dry, splitting open; medium sized climbers. *Hantu duri* ..... *Zanthoxylum nitidum*
3. Leaves with 3 leaflets; leaf stalk not winged; twigs and leaf-stalks not prickly, but axils with usually recurved spines. Flowers in axillary racemes or panicles; fruits globose to ellipsoid, mucilaginous, without pulp-vesicles; seeds 1-3 ..... *Luvunga* Buch.-Ham. RIDLEY (1922)  
354. SWINGLE (1943) 244. Indomalaya,  
c. 12 spp., 2 spp. in Malaya. Fruits look  
and smell like small limes.
4. Erect shrub of mangrove or Nipa fringe; fruit 3-4-celled and angled, resembling an angled lemon; seeds very large, to 35mm long; ovules usually 4 per cell, but one maturing. Leaves simple; spines single or paired, straight ..... *Merope*
4. Not as above ..... 5
5. Buds densely covered with minute rusty-reddish-brown hairs; leaves usually alternate, but rarely opposite, simple or compound pinnate with up to about 9 leaflets. Ovary 2-5-celled, the cells 1-ovulate. Fruit slightly fleshy, resinous ..... *Glycosmis*

5. Buds glabrous, or if hairy, the hairs whitish, tawny, or grey. Leaves simple or pinnate, opposite or alternate. Ovary cells usually with 2 or more ovules (except *Paramignya*). Fruit dry or fleshy ..... 6
6. Twigs and often also trunk prickly, with scattered prickles ..... *Zanthoxylum*
6. Twigs unarmed, not prickly, sometimes with solitary or paired spines in the axils ..... 7
7. Leaves mostly with 3 to many leaflets ..... 8
7. Leaves simple or at most with 3 leaflets ..... 15
8. Leaves with 9-13 leaflets, those at base smallest, in a graded series with those at leaf tip the largest; leaf stalk flattened, narrowly winged; fruit large, ellipsoid, firm, the pulp fleshy and resinous; seeds numerous, large ..... *Merrillia*
8. Leaves with subequal leaflets, leaf-stalk winged or not; fruit various ..... 9
9. Leaves with 5-31 leaflets, rarely a few with only 3; leaves sometimes pubescent ..... 10
9. Leaves usually with 3-7, often 5, leaflets ..... 13
10. Inflorescence terminal, large, open, to 30cm long; flowers racemously disposed, well spaced; crushed tissues foul-smelling ..... *Clausena excavata*
10. Inflorescence up to 15cm long; flowers cymosely disposed, crowded; crushed parts fragrant or not ..... 11
11. Leave opposite; trees; fruit a dehiscent capsule of follicles ..... *Tetradium*
11. Leaves alternate; trees or shrubs; fruit a berry ..... 12
12. Leaves faintly scented if crushed; unripe fruits oblong; wild plants ..... *Micromelum*
12. Leaves spicy-scented if crushed; fruits globose; cultivated plants ..... *Murraya koenigii*
13. Leaflets 5, large, c. 12-18cm long; flowers very small (2.5mm long), in panicles c. 30 cm long; ovary 4-celled, glabrous, with bulging glands ..... *Clausena macrophylla*
13. Leaflets 3-7, smaller, usually somewhat rhomboid to obovate; ovary 2-6-celled ..... 14
14. Leaf stalk broadly winged; fruit large, woody, globular, 5-7.5 cm wide; deciduous, cultivated tree ..... *Limonia acidissima*
14. Leaf stalk not winged; fruit small, berrylike, to 12mm wide; seeds 1 or 2, hairy; wild or cultivated, evergreen, small tree or shrub ..... *Murraya*
15. Leaves with usually 3, sometimes only 1 or 2, leaflets. .... 16
15. Leaves simple or unifoliolate ..... 18
16. Twigs unarmed; leaves opposite; fruit indehiscent ..... *Melicope*
16. Twigs armed with axillary spines; leaves alternate; fruit indehiscent ..... 17
17. Flowers 4- or 5-merous; fruit many-seeded, with hard woody shell; deciduous cultivated tree ..... *Aegle marmelos*
17. Flowers 3-merous; fruit 1-3-seeded, fleshy; evergreen cultivated shrub ..... *Triphasia trifolia*
18. Twigs unarmed; leaves opposite ..... 19
18. Twigs armed with axillary spines; leaves alternate ..... 22
19. Fruit dry, dehiscent ..... 20
19. Fruit fleshy, indehiscent ..... 21
20. Terminal bud glabrous; flowers with 4 stamens alternating with 4 staminodes; seeds winged *Tetractomia*
20. Terminal bud nearly glabrous to velutinous; flowers with 4 or 8 stamens (or staminodes); seeds not winged. .... *Melicope*
21. Flowers bisexual; petals valvate; staminal filaments hairy ..... *Acronychia pedunculata* (L.) Miq., Fl. Ind. Bat. Suppl. (1861) 532, including *A. laurifolia* Bl. fide Hartley, J. Arnold Arbor. 55 (1974) 549.
21. Flowers unisexual; petals imbricate; staminal filaments glabrous ..... *Maclurodendron*
22. Axillary spines short, curved, paired; fruit small, round, 2-seeded; shrubby plant.. *Paramignya cuspidata*
22. Axillary spines longer, single or paired, straight; fruit usually 4cm wide or more, seeds usually more than 2; shrub or tree ..... 23

23. Fruit 3-5-celled, each cell with 1 or 2 seeds; stamens twice as many as petals; small, wild trees *Atalantia*  
 23. Fruit 3-18-celled, each cell with 2-12 seeds; stamens 4 (or more) times as many as petals ..... 24
24. Fruit 3-7-celled, each cell with 1 or 2 seeds; stamens connate basally; fruit rind thin, soft, palatable;  
 cultivated shrub ..... *Fortunella*
24. Fruit usually 8-18-celled, each cell with 4-12 seeds: stamens free or basally connate, the filaments irregularly,  
 often loosely, connate; fruit rind firm but flexible, somewhat fleshy, not or marginally palatable; wild or  
 cultivated shrub or tree ..... *Citrus*

Supplementary notes:

Herbs of the genus *Ruta* (*R. graveolens* L.), the Rue plant, are occasionally grown as pot plants; they are readily recognizable by their herbaceous habit, glaucous foliage of compound leaves, pungent aroma, yellow flowers, capsular fruits, and angular seeds.

There is a recent revision of *Clausena* in : Molino, J.-F. (1994). Revision du genre *Clausena* Burm. f. (Rutaceae). Bull. Mus. Hist. Nat. (Paris), ser. 4, Sect. B, Adansonia 16(1), 105-153

## Citrus L.

*Citrus halimii* Stone, in Stone, Lowry, Scora & Jong, *Biotropica* 5 (1973) 102.

(after Sultan Abdul Halim Mu'azzam Shah ibni Almarhum Sultan Badlishah of Kedah.

*Citrus* sp. A: Stone, in Tree Flora of Malaya 1 (1972) 375.

A tree up to 23m tall, trunk cylindric, straight, with ascending branches; bark smooth gray, thin; wood white. *Leaves* elliptic or narrowly elliptic, thin coriaceous, margins entire to obscurely and minutely subcrenulate, undersurface slightly paler than upper, somewhat olivaceous when dry, the blades 8-15cm long, 3.5-7.5 cm wide, copiously glandular but the adult leaves not highly fragrant; petioles articulated at both ends, usually 1-2cm long, the margins distinctly but narrowly winged. Main lateral nerves 7-11 pairs. *Flowers* solitary, in axils, pedicels to 3.5mm long; calyx of 5 deltate sepals with minutely ciliate margins; petals white, 3-5 (or more) mm long. Stamens 18-20, free or the filaments loosely connate in small groups of 2 or 3, glabrous, the anthers yellow. Ovary 6-10-celled, on a flat disc; style columnar, with 5-6-angled flat stigma; ovary cells with 1-3, rarely 5, ovules, *Fruit* about 5 x 5 cm but variable in size, subglobose to pyriform, at apex slightly concave, the rind glossy deep yellow, bumpy, copiously glandular, firmly adherent, about 6mm thick, with thin white endocarp; pulp vesicles numerous, subglobose to pyriform with slender stalk, pale greenish to yellowish-white translucent, containing acid juice. *Seeds* numerous, monoembryonic, to 18+ per fruit, large, flat, about 20 x 9mm, 3-3.5mm thick, narrowed at base, veiny rugulose, the chalazal cap pale magenta-pink; cotyledons white, the hypocotyl pale greenish-white.

S. Peninsular Thailand and Peninsular Malaysia, and Borneo (Sabah). In Malaya mostly in the Main Range at moderate altitudes typically between 2000 and 4500 feet (640-1450m). on ridges in submontane forest.

N.v. "limau kedut nera" or "Limau Kedangsa."

## Glycosmis Correa

(Gr. glucus = sweet; osmion=smell)

Ann. Mus. Paris 6 (1805) 384. Ridley, Flora 1 (1922) 348-51. Burkill, Dictionary (1935) 1086. Corner, Wayside Trees (1940) 571. Swingle, Citrus Ind. (1943) 153. Phoenicimon Ridl. (under Sapindaceae), Flora 5 Suppl. (1925) 301. Stone, in Whitmore, Tree Fl. Malaya 1 (1972) 380.

A genus of about 45 species from India and Sri Lanka through Burma, Thailand, southern China, Indochina, Taiwan, throughout Malesia E to NW & NE Australia, and introduced/naturalized in Florida, W. Indies, and elsewhere.

Continuing studies of this genus (Stone, Proc. Acad. Nat. Sci. Philadelphia 137, 1985) have greatly changed the taxonomy and nomenclature of this group and thus of the earlier account in the Tree Flora of Malaya, so the present account must completely replace the earlier one.

### Key to Peninsular Malaysia species of *Glycosmis*

1. Leaves all simple ..... 2
1. Leaves with 3 or more leaflets, or rarely with 2 or 1 leaflet, these mingled with multifoliate leaflets on the same plant ..... 3
2. Leaves leathery, oblong-obovate, to 6cm wide, with obscure veins, alternate; inflorescences much reduced, axillary ..... *G. crassifolia* Ridl. J. Roy. Asiat. Soc. Str. Br. 75 (1917) 14. Endemic, rare; known from Malacca and Pahang (Taman Negara).
2. Leaves thin coriaceous, elliptic to ovate, wider than 6cm, with obvious veins, sometimes opposite ..... *G. chlorosperma* (Bl.) Spr. var *lindleyana* (Swingle) Stone, Proc. Acad. Nat. Sci. Phila. 137 (1985) 3. (*G. lindleyana* Swingle, Citrus Ind. 1 (1943) 155; *G. macrophylla* Lindl.: Ridl. Flora 1 (1922) 349. Penang, Perak.
3. Leaves of 3 leaflets, or sometimes only 2 or 1 or rarely 4 ..... 4
3. Leaves with 5 or more leaflets, rarely 4 or 3 ..... 7
4. Ovary reddish pubescent; leaflets usually 1-3, elliptic, with about 6 pairs of secondary veins. Sometimes on limestone hills ..... *G. puberula* Lindl. ex Oliver J. Linn Soc. Bot. 5 Suppl. 2 (1861) 39. Penang and Perak; S. Thailand, and a variety in Vietnam
4. Ovary glabrous or with a very few, ephemeral, scattered hairs ..... 5
5. Fruits to 2cm diam.; leaflets large, to 25 x 6cm, ovate, acuminate with 5-8 pairs of secondary veins; inflorescence pseudoterminal ..... *G. collina* Stone Proc. Acad. Nat. Sci. Phila. 137 (1985) 4. *G. macrocarpa* sensu Ridl. Flora 1 (1922) 349, non Wight 1840. Perak (*G. Bubu*), Pahang (Fraser's Hill). Montane. Endemic.
5. Fruits smaller; leaflets smaller and/or of different form, with 4-15 pairs of secondary veins; inflorescences axillary ..... 6
6. Leaflets up to c. 7.5 cm long, elliptic, with rather few (4-6) secondary veins; fruits c. 4-5mm diam. Ovary glabrate, at first usually with a very few ephemeral scattered hairs. Coastal areas, especially limestone, and limestone hills ..... *G. mauritiana* (Lam.) Tan., Bull. Soc. Bot. France 75 (1928) 708. *G. rupestris* Ridl. J. Roy. Asiat. Soc. Str. Br 59 (1911) 81; Flora 1 (1922) 350. Perlis, Kedah, Perak, Penang, Kelantan. Widespread and variable; also in



- India, Sri Lanka, Andaman Islands, Nicobar Islands, Mauritius, Laos, Hainan, and SE Borneo.
6. Leaflets often 12-15+ cm long, elliptic-lanceolate, with up to 15-16 pairs of secondary veins; fruit 10-12 mm diam. Ovary quite glabrous. Coastal areas, and secondary vegetation, sometimes in cultivation ..... *G. pentaphylla* (Retz.) DC. Prod. (1824) 538. *G. citrifolia* sensu Ridley, Flora 1 (1922) 349, non Lindley, 1826. In Malaya chiefly in the north. Also in India, Sri Lanka, Burma, Thailand, SW China, and Indochina.
  7. Leaflets 5-7, leathery, each with about 18 pairs of secondary veins, glabrous above, reddish-scurfy beneath, large (to 23cm long and 10cm wide, the petiole 6mm long. Panicles elongated, to 20 cm long, densely reddish-pubescent, almost spikelike, with densely crowded small flowers; ovary 3-celled ..... *G. decipiens* Stone, Tree Fl. Mal. 1 (1972) 381. *Phoenicimon rubiginosa* Ridl. Flora 5 Suppl. (1925) 301; not *G. rubiginosa* Ridl. Kew Bull. (1925) 78. Negri Sembilan, Pahang, Johore, Trengganu; Pulau Tioman and Anambas Islands. Rare but distinctive.
  7. Leaflets large or considerably smaller and with few pairs of secondary veins; inflorescences much shorter, not spikelike ..... 8
  8. Ovary reddish-puberulent, 3-celled; leaflets 5 to 7, up to 34 cm long, but with only 6-9 pairs of secondary veins; petals puberulent outside ..... *G. macrophylla* (Bl.) Miq. Fl. Ned. Ind. 1 (1859) 522. *Sclerostylis macrophylla* Bl. Bijdr. (1825) 135. *G. sapindoides* Lindl. ex Oliver J. Linn. Soc. Bot. 5 Suppl. 2 (1861) 38. *G. elata* Ridl. J. Fed. Mal. St. Mus. 10 (1920) 130. Kedah, Kelantan, Penang, Andaman and Nicobar Islands, Thailand, Sumatra, Java, Sunda Isl., Kei Isl., Papua and W. Australia.
  8. Ovary glabrous, 5- or 4-celled ..... 9
  9. Leaflets 7-12, linear-lanceolate; rheophytic shrub ..... *G. perakensis* Narayanaswamy, Rec. Bot. Surv. India 14 (1941) 59. Perak, Pahang. Endemic.
  9. Leaflets mostly 5-7, rarely 9 or only 3 or 4, not linear-lanceolate; not rheophytic ..... 10
  10. Leaflets small, usually 3-5, rarely 1 or 7, mostly 2.5-5 cm long, rounded and slightly notched at apex; flowers 4-merous ..... *G. trichanthera* Guillaumin Bull. Bot. Soc. France 91 (1945) 216. Limestone hills in various states; W of Main Range as var. *trichanthera* (syn. *G. calcicola* Stone, Gard. Bull. Sing. 26 (1972) 55); in Kelantan, var. *kelantanica* (Stone) Stone, Proc. Acad. Nat. Sci. Phila. 137 (1985) 22, with much larger leaflets. Restricted to karst limestone. The typical variety occurs in Vietnam; another is found in Burma, and one more in Sumatra. The notched leaflet tips together with small 4-merous flowers are reliable characters. This is a sharply distinct species.
  10. Leaflets somewhat larger, not rounded and notched at the tip. Flowers 5-merous ..... 11
  11. Leaflets usually elliptic to ovate, with wide-spaced rather few veins prominent beneath; inflorescences terminal ..... 12
  11. Leaflets mostly elliptic-lanceolate, with rather numerous fine secondary veins; inflorescences axillary ... *G. pentaphylla* (Retz.) DC. (see above)

12. Inflorescences glabrous or nearly so ..... *G. chlorosperma* (Bl.) Sprengel, Syst. Veg. ed. 16, 4 (1827) 162. *Cookia chlorosperma* Bl. Bijdr. 3 (1925) 135. *G. malayana* Ridl. J. Roy. Asiat. Soc. Str. Br. 75 (1917) 12. *G. monticola* Ridl. 1.c. Widespread through the Malay Peninsula, lowlands and hills, in forest; common in W. Malesia. (1) var. *chlorosperma*: Widespread in the Peninsula. (2) var. *angustifolia* Narayana-swamy, Rec. Bot. Surv. India 14 (1941) 43. Perak, very local; S. Borneo. With narrow leaflets. (3) var. *paraphyllophora* Stone, Proc. Acad. Nat. Sci. Phila. 137 (1985) 3. Penang, Kedah, S. Thailand. Inflorescence bases with conspicuous paraphylls. (4) var. *lindleyana* (Swingle) Stone 1.c. Penang. With large 'simple' opposite leaves.
12. Inflorescences densely reddish-pubescent ..... *G. tomentella* Ridl. J. Roy. Asiat. Soc. Str. Br. 75 (1917) 14; Flora 1 (1922) 350. Selangor (G. Nuang), rare in montane forest. Also in Sumatra.

## Limonia L.

*Limonia acidissima* L. is the correct name for *Feronia limonia* (L.) Swingle, as used in Tree Flora Mal. 1 (1972) 370 (*F. elephantum* Corr. is another synonym). The genus *Feronia* is a synonym of *Limonia* which is monotypic. This species is exotic in the Malayan flora, and occurs only in cultivation. The woody-shelled fruits, the leaves with strongly winged rachis and usually 5 leaflets, and the deciduous habit distinguish it readily. For a fuller explanation of the nomenclature, see Stone & Nicholson, Taxon 27 (1978) 551.

## Maclurodendron Hartley

Gard. Bull. Sing. 35 (1982) 1-19.

(After F.A. MaClure, American botanist specialized in bamboos)

Small to medium trees, all apparently dioecious. Indumentum brownish to rusty, of simple or fascicled hairs. Leaves opposite, unifoliate, blades pinnately veined, pellucid glandular-punctate. Inflorescences axillary in upper axils, cymose, paniculate, or racemose. Flowers unisexual, 4-merous, the sepals valvate, petals narrowly imbricate, deciduous; stamens 8, free, unequal, those opposite petals shorter than the others, the longer ones about as long as the petals; filaments glabrous; anthers dorsifixed, sterile in pistillate flowers. Gynoecium 4-carpellate, rudimentary in staminate flowers, with an irregularly, shallowly 8-lobed disc; carpels 2-ovulate, the ovules collateral to subcollateral; style straight, with 4-lobed capitate stigma. Fruit a syncarpous drupe of 4 cells, with glandular leathery exocarp, pergamentaceous endocarp, and 1 or 2 ovoid to reniform glossy black seeds per cell; endosperm copious; embryo straight; cotyledons flattened.

A genus of 6 species from Burma, E to Indochina and S China, in W Malesia from the Malayan Peninsula to the Philippines; two species in Peninsular Malaysia.

### Key to Malaysian species of *Maclurodendron*

1. Flower buds 2.5-3 mm wide, sepals and petals densely pubescent outside; style scars distinct on fruit as 4 crowded dots. Leaflet blades 23.5-18.5cm long ..... *M. magnificum* Hartley, Gard. Bull. Sing. 35 (1982) 15. Pahang (Genting Highlands, Ulu Kali, 1500 m). Endemic. Montane forest.
1. Flower buds 1-2mm wide, sepals and petals pubescent to glabrous outside; style scar unitary (scars confluent) at drupe apex. leaflet blades 5.5 - 24cm long ..... *M. porteri* (Hook.f.) Hartley, Gard. Bull. Sing. 35 (1982) 8. *Acronychia porteri* Hook. f. Fl. Brit. India 1 (1875) 498. All states and Singapore; Burma; W.Malesia.

### Melicope J. R. & G. Forster

by T. G. HARTLEY

Char. Gen. Pl. (1775) 28, ed. 2 (1776) 55. Engler in Engler & Prantl, Nat. Pflanzenfam. ed. 2.19a (1931) 231. Hartley, Sandakania 4 (1994) 47.

(Gr. *meli*, honey, and *kope*, a cutting, referring to the emarginate lobes of the nectar-secreting, intrastaminal disc)

Shrubs (rarely scandent) or trees. *Leaves* opposite or whorled, digitately trifoliolate or unifoliolate. *Inflorescences* cymose or thyriform or sometimes reduced to solitary flowers, axillary or ramuligerous (i.e., on branchlets below leaves) or rarely terminal, ramigerous, or cauligerous. *Flowers* small, bisexual or functionally unisexual; sepals 4; petals 4, distinct, valvate or narrowly imbricate; stamens (rudimentary in ♀ flowers) 8 or 4 or rarely 8-4, distinct; disc intrastaminal, pulvinate to annular or cupular; gynoecium (rudimentary or sometimes obsolete in ♂ flowers) 4-carpellate, the carpels connate basally or up to their full length, with a common apical or subapical style or the styler elements rarely becoming divergent, the stigma punctiform to capitate, peltate, or 4-branched, the ovules 2 or 1 per carpel. *Fruit* of 1-4 basally connate follicles (the abortive carpels, if any, persistent) or grading to syncarpous (carpels united into a 4-locular, loculicidally dehiscent capsule); endocarp pergamentaceous to cartilaginous, adnate to or separate from epicarp in mature fruit but not expelled at dehiscence. *Seeds* solitary or in pairs, remaining attached in dehisced fruit; testa with thick inner layer of dense, black sclerenchyma and spongy outer layer bounded externally by a shiny, black pellicle; endosperm copious; embryo straight or slightly curved, the cotyledons ± flattened, elliptic, planate, the hypocotyl superior.

Malagasy and Indo-Himalayan regions eastward to the Hawaiian and Marquesan Islands and south to New Zealand. About 230 species, 10 of which occur in the Malayan Peninsula (i.e., in Peninsular Malaysia and/or Singapore).

*Melicope* is characterized mainly by its combination of opposite or whorled, digitately trifoliolate or unifoliolate leaves, dehiscent fruit, and shiny, black, pelliculose seeds which remain attached in the dehisced fruit. *Euodia* J.R.& G. Forster, with which *Melicope* was long confused, consists of seven species and

ranges from New Guinea and northeastern Australia east to Samoa, Tonga, and Niue. Like *Melicope*, it has opposite, digitately trifoliolate or unifoliolate leaves and dehiscent fruit, but its seeds are neither shiny nor pelliculose and they are forcibly expelled, along with the endocarp, when the fruit dehisces. This classification of the two genera was first proposed in a revision of the southeast Asian genus *Tetradium* Lour. (Hartley, Gard. Bull. Sing. 34 (1981) 91-131), which itself was long confused with *Euodia*, and was followed in a recent account of the Bornean species of *Melicope* (Hartley, Sandakania 4 (1994) 47-74).

The manner of attachment of the seed in the dehiscent fruit or *Melicope* is variable and provides a useful taxonomic character. In some species, the attachment is either by a partially detached axile strip of pericarp tissue or by a partially detached raphe, or by both. This kind of attachment, which is seen in species 1, as enumerated below, is designated as Type A. In other species, neither the pericarp nor the raphe detaches and the two are connected by a funiculus which ranges up to about 3 mm in length. This manner of attachment, which is seen in species 2-10 below, is designated as Type B.

Seeds of *Melicope* are often irregularly angled when two develop in a single fruiting carpel. These shapes, which are caused by crowding, are not given in the descriptions.

In the above-mentioned account of the Bornean species of *Melicope*, full descriptions were given for five species that also occur in the Malayan Peninsula, namely, *M. accedens* (Blume) T. Hartley, *M. denhamii* (Seem.) T. Hartley, *M. glabra* (Blume) T. Hartley, *M. hookeri* T. Hartley, and *M. lunu-ankenda* (Gaertn.) T. Hartley. Those descriptions are not repeated here. The synonymies given herein are intended to be relevant only to the Malayan Peninsula. *Melicope accedens*, *M. denhamii*, *M. glabra*, and *M. lunu-ankenda* have additional synonyms outside this region. With one exception (see *Evodia* sensu Gaertner, mentioned in the synonymy of *M. lunu-ankenda*), the original spelling *Euodia* is used throughout the synonymies, correcting the orthographic variant *Evodia*, which was used by most of the authors.

### Key to species of *Melicope* in the Malayan Peninsula

1. Leaves, or most of them, unifoliolate ..... 2
1. Leaves, or most of them, trifoliolate ..... 3
2. Flowers with 8 stamens; endocarp separate in mature fruit; young branchlets 4-5 mm wide in third internode, becoming manifestly corky ..... 1. *M. suberosa*
2. Flowers with 4 stamens; endocarp adnate in mature fruit; young branchlets 2.5-3.5 mm wide in third internode, not becoming manifestly corky ..... 10. *M. pahangensis*
3. Leaflet blades (as seen in the Malayan Peninsula) lobed, sinuate, or repand; plants cultivated or possibly escaped ..... 2. *M. denhamii*
3. Leaflet blades entire ..... 4
4. Trichomes mostly fasciculate or stellate ..... 7. *M. hookeri*
4. Trichomes, or most of them, simple ..... 5



5. Petals (2.4-) 3.3-4 mm long, the abaxial surface appressed-pubescent; fruiting carpels 8-10 mm long, the endocarp glabrous; indumentum of leaflet blades mostly restricted to midrib and margin ..... 9. *M. pachyphylla*
5. Petals (as seen in the Malayan Peninsula) 1-3 mm long, the abaxial surface glabrous or with sparse indumentum; fruiting carpels (as seen in the Malayan Peninsula) 2.5-5 mm long, or, if larger, then the endocarp pubescent; indumentum of leaflet blades, if present, not as above ..... 6
6. Fruiting carpels (7.5-) 10-11 mm long; endocarp and locules of ovary with indumentum 8. *M. macrocarpa*
6. Fruiting carpels 2.5-5 mm long; endocarp and locules of ovary glabrous ..... 7
7. Petals 1-1.5 mm long, glabrous, persistent in fruit; fruiting carpels 2.5-3 mm long ..... 5. *M. corneri*
7. Petals (1.5-) 2-2.5 (-3) mm long, with indumentum, especially adaxially, or glabrous, deciduous in fruit; fruiting carpels 3-5 mm long ..... 8
8. Terminal leaflet blades obovate or broadly so, (7.5-) 9-16.5 cm long, the main veins plane or impressed above, 9-15 on each side of midrib, divergent at angle of 50-60°, the apex usually abruptly and obtusely short-acuminate; main branches of inflorescences ascending; fruiting carpels 3-4 mm long ..... 3. *M. glabra*
8. Terminal leaflet blades (as seen in the Malayan Peninsula) elliptic to obovate, 6-30 cm long, the main veins prominent to impressed above, 11-22 on each side of midrib, divergent at angle of 60-70°, the apex usually acuminate; main branches of inflorescences spreading or ascending; fruiting carpels 3.5-5 mm long ..... 9
9. Leaflet blades glabrous or nearly so, up to 22 cm long, the main veins prominent above; main branches of inflorescences usually ascending; fruiting carpels about 5 mm long ..... 4. *M. lunu-ankenda*
9. Leaflet blades nearly glabrous to pubescent below, up to 30 cm long, the main veins usually impressed above; main branches of inflorescences usually spreading; fruiting carpels 3.5-4.5 mm long ..... 6. *M. accedens*

# 1. *Melicope suberosa* B. Stone

Gard. Bull. Sing. 36 (1983) 94, fig. 1,2; tab. 1. Type: Peninsular Malaysia: Pahang: Genting Highlands, Gunong Ulu Kali, Stone & Lowry 15338 (CANB, Isotype).

Tree to 10 m high, trunk to 15 cm diam., like the branches with rugose pale corky bark; trichomes simple or fasciculate. Young branchlets like the petioles glabrous or nearly so, becoming manifestly corky, 4-5 mm wide in third internode; terminal bud densely puberulent. *Leaves* opposite, unifoliate, 7.5-21.5 cm long; petiole 1-4 cm long, 1-2 mm wide at middle; petiolule obsolete; leaflet blade chartaceous, glabrous, elliptic or elliptic-obovate, 6.5-17.5 x 3-9.5 cm, the base obtuse to acute, the margin entire or in occasional leaves few-crenulate toward apex, the apex obtuse to subacuminate, the midrib plane above, the main veins prominent above, 10-15 per side, divergent at angle of 65-70°, the veinlet reticulation ± obscure. *Inflorescences* axillary, few-flowered, 1.5-2 x 1.3-1.5 cm, the peduncle nearly glabrous or sparsely puberulent, 0.8-1.3 cm long, the pedicels puberulent, 1.5-2 mm long (about 3 mm long in fruit). *Flowers* unisexual (only ♀ seen), plants probably dioecious; sepals puberulent or sparsely so abaxially, glabrous adaxially, connate at base, ovate-triangular, about 1.5 mm long, persistent in fruit; petals greenish white, narrowly imbricate, sparsely puberulent abaxially, glabrous adaxially, ovate-elliptic, about 4 mm long, deciduous in fruit; stamens 8, infertile, the antesealous ones about 2 mm long, the filament glabrous, narrowly obtuse at apex, the anther 0.6-0.8 mm long; disc glabrous; gynoecium 2.2-2.7 mm long, the ovary puberulent or sparsely so, the carpels 2-ovulate, the style puberulent in proximal 1/2, including stigma 1.5-2 mm long, the stigma capitate,

weakly 4-lobed, about 0.6 mm wide. *Fruiting carpels* connate at base, divaricate, subglobose to broadly ellipsoid, about 8 mm long, the exocarp dry, glabrate, the endocarp glabrous, separate; seed attachment Type A; *seeds* ellipsoid, about 7 mm long.

Known only from the type locality in central Peninsular Malaysia; forest at 1550 m.

*Melicope suberosa* is most nearly related to *M. jugosa* T. Hartley and *M. sororia* T. Hartley, which are endemic to Borneo. It differs from those species mainly in having manifestly corky branchlets, persistent sepals, puberulent petals and ovary, and smaller fruiting carpels. Among its congeners in the Malayan Peninsula, it is the only species with 8-staminate flowers, separate endocarp, and Type A seed attachment.

The specific epithet (from the Latin *suberosus*, corky) refers to the thick bark of the branches and trunk.

## 2. *Melicope denhamii* (Seem.) T. Hartley

Sandakan 4 (1994) 57. *Picrasma denhamii* Seem., Fl. Vit. (1865) 33.

Type: New Hebrides : Aneitum [Aneityum], McGillivray 46 (BM, Holotype).

*Aralia quercifolia* Anon., Gard. Chron. (1881) 785, fig. 140, nom. prov.; hort. ex Truff., Rev. Hort. (1891) 224. *Euodia quercifolia* (hort. ex Truff.) Ridl., Gard. Chron., ser. 3, 76 (1924) 303. Type not designated. The illustration of *Aralia quercifolia* is reasonably adequate for the identification of this plant.

*Euodia ridleyi* Hochr., Icon. Bogor 2 (1905) tab. 151. *Euodia schullei* var. *ridleyi* (Hochr.) Lauterb., Bot. Jahrb. Syst. 55 (1918) 230. *Euodia suaveolens* var. *ridleyi* (Hochr.) Bakh. f., Blumea 6 (1950) 365. Probable type: Java: Bot. Gard. Bogor (ex Bot. Gard. Singapore), Backer, Dec. 1904 (U, Isotype).

Borneo east to the southern Philippines and Caroline Islands and southeast throughout eastern Malesia to the Solomon Islands, New Hebrides, and Fiji. In the Malayan Peninsula, only putative cultigens of the species are known. These are represented by collections made from Bot. Gard. Univ. Malaya (Kuala Lumpur) and Bot. Gard. Singapore.

From their congeners in the Malayan Peninsula, the cultigens of *Melicope denhamii* (which apparently originated in Papuasias) are immediately recognizable by their lobed, sinuate, or repand leaflet blades. The specific epithet commemorates H. M. Denham, a British sea captain.

## 3. *Melicope glabra* (Blume) T. Hartley

Sandakan 4 (1994) 60. *Fagara glabra* Blume, Catalogus (1823) 40. *Euodia glabra* (Blume) Blume, Bijdr. (1825) 245. *Ampacus glabra* (Blume) Kuntze, Revis. Gen. Pl. 1 (1891) 98. Type: Java: Blume (US, Lectotype, designated by Hartley, opp. cit.).

*Euodia kingii* Engl. in Engl. & Prantl. Nat. Pflanzenfam. III. 4 (1896) 121. Type: Malakka [Malaya sensu Engler]: "*E. glabra* King in herb." The B material of this was presumably lost. It was probably the same plant that King (J.Asiat. Soc. Bengal, pt. 2, Nat. Hist. 62 (1893) 208) correctly identified as *Euodia glabra* (Blume) Blume.

Malayan Peninsula to Sumatra and western Java. In the Malayan Peninsula, known from Penang, Perak, Trengganu, Selangor, Pahang, Johore, and Singapore; primary and secondary forest from near sea level to 450 m.

*Melicope glabra* is most nearly related to *M. lunu-ankenda*, differing mainly in the following combination of features: terminal leaflet blades obovate or broadly so, (7.5-) 9-16.5 x 4-12 cm, the apex abruptly and usually obtusely acuminate or sometimes rounded, obtuse, or emarginate, the midrib impressed above, the main veins plane or impressed above, 9-15 per side, divergent at angle of 50-60°; fruiting carpels 3-4 mm long.

#### 4. *Melicope lunu-ankenda* (Gaertn.) T. Hartley

Sandakan 4 (1994) 61. *Fagara lunu-ankenda* Gaertn., Fruct. Sem. Pl. 1 (1788) 334, tab. 68, fig. 9. *Fagara zeylanica* J.F. Gmelin, Syst. Nat. 2 (1791) 258 (not seen); Syst. Veg. 1 (1796) 258, nom. illeg. *Zanthoxylum zeylanicum* (J. F. Gmelin) DC., Prodr. 1 (1824) 728, nom. illeg. *Euodia lunu-ankenda* (Gaertn.) Merr., Philipp. J. Sci. (Bot.) 7 (1912, publ. 1913) 378, as *lunur-ankenda*. Type: Ceylon, König (L, Holotype).

[*Fagara triphylla* sensu Roxb., Fl. Ind. 1 (1820) 436, excl. syn., non Lam. 1798.] *Zanthoxylum roxburghianum* Cham., Linnaea 5 (1830) 58. *Euodia roxburghiana* (Cham.) Benth., Fl. Hongk. (1861) 59. *Ampacus roxburghiana* (Cham.) Kuntze, Revis. Gen. Pl. 1 (1891) 98. *Euodia malayana* Ridl., Fl. Malay Penins. 1 (1922) 342, nom. illeg. Type: cult. Bot. Gard. Calcutta; introduced by Roxburgh from Penang (not seen).

Roxburgh's description, apparently drawn up from living material at Calcutta, is reasonably adequate for the identification of this plant. It is doubtful if a type was preserved. Roxburgh incorrectly gave Linnaeus as the author of *Fagara triphylla*. In the reference he cited (Sp. Pl. ed. Willd. 1 (1798) 666). Willdenow correctly referred the species to Lamarck.

Himalaya southward to Ceylon, Java, Celebes, and southwestern Philippines. In the Malayan Peninsula, known from Province Wellesley, Perak, Selangor, Pahang, Negri Sembilan, Malacca, Johore, and Singapore; coastal and inland primary and secondary well-drained forest and peat swamp; to 60 m.

*Melicope lunu-ankenda* is most nearly related to *M. glabra* (q.v.). The specific epithet is a Ceylonese name for the plant.

#### 5. *Melicope corneri* T. Hartley, sp. nov.

Type: Peninsular Malaysia: Selangor: Ulu Gombak, Carrick 1468 (L, Holotype).

Arbor 4.5-7.5 m alta, trichomatibus pro parte maxima simplicibus; foliis trifoliolatis, 34-51 cm longis; foliolorum laminis chartaceis, saltem subtus in costa et venis primariis et supra in costa ± sparse pubescentibus, in foliolo terminali ellipticis usque obovatis, 20-31 x 7-12 cm; inflorescentiis axillaribus, multifloris, 4-10 x 3-8 cm, ramis principalibus patentibus; floribus unisexualibus (plantae dioeciae); sepalis ca. 0.5 mm longis, in fructu persistentibus; petalis glabris, 1-1.5 mm longis, in fructu persistentibus; staminibus 4, in floribus ♂ ca. 2.5 mm longis (in floribus ♀ 1-1.5 mm longis), filamento glabro, apice subulato usque filiformi, anthera ca. 0.6 mm longa (in floribus ♀ ca. 0.3 mm longa); gynoecio in floribus ♀ ca. 1 mm longo (in floribus ♂ ca. 0.3 mm longo), stigmatibus capitatis, inconspicue 4-lobatis; carpellis fructificantibus basi connatis, 2.5-3 mm longis, endocarpio glabro, saltem apicem versus adnatis; seminibus per Type B affixis, ca. 2 mm longis.



Tree 4.5-7.5 m high, trichomes mostly simple. Young branchlets like the petioles pubescent, 5.4-7 mm wide in third internode; terminal bud velutinous. *Leaves* opposite, trifoliolate, 34-51 cm long; petiole 12-19 cm long, 2-4 mm wide at middle; petiolule in lateral leaflets obsolete or up to 3 mm long, in terminal leaflet 2-5 mm long; leaflet blades chartaceous,  $\pm$  sparsely pubescent, at least on midrib and main veins below and on midrib above, in lateral leaflets elliptic or elliptic-obovate, in terminal leaflet elliptic to obovate, 20-31 x 7-12 cm, the base in lateral leaflets obtuse to acute, in terminal leaflet acute to subattenuate, the margin entire, the apex acuminate, the midrib and main veins slightly impressed above, the main veins in terminal leaflet 15-20 per side, divergent at angle of 60-70°, the veinlet reticulation prominulous to obscure. *Inflorescences* axillary, many-flowered, 4-10 x 3-8 cm, the axis and branches pubescent, the peduncle 1-5 cm long, the main branches spreading, the pedicels puberulent or sparsely pubescent, 0.7-2 mm long (1.5-2 mm long in fruit). *Flowers* unisexual, plants dioecious; sepals sparsely puberulent abaxially, glabrous adaxially, connate at base or up to 1/4 their length, ovate or ovate-triangular, about 0.5 mm long, persistent in fruit; petals cream or greenish, narrowly imbricate, glabrous, ovate-elliptic, 1-1.5 mm long, persistent in fruit; stamens 4, in  $\sigma$  flowers about 2.5 mm long (1-1.5 mm long in  $\rho$  flowers), the filament glabrous, subulate to filiform at apex, the anther about 0.6 mm long (about 0.3 mm long in  $\rho$  flowers); disc pubescent or sparsely so; gynoecium in  $\rho$  flowers about 1 mm long (about 0.3 mm long in  $\sigma$  flowers), the ovary pubescent or sparsely so, the carpels 2-ovulate, the style pilosulose, at least in proximal 1/2, including stigma about 0.7 mm long, the stigma capitate, weakly 4-lobed, 0.25-0.3 mm wide. *Fruiting carpels* connate at base, divaricate, subglobose or broadly ovoid to obovoid, 2.5-3 mm long, the exocarp subfleshy, glabrate, the endocarp glabrous, adnate, at least toward apex; seed attachment Type B, the funiculus about 0.6 mm long, 0.3-0.5 mm wide at middle; *seeds* ellipsoid, about 2 mm long.

Endemic to Peninsular Malaysia; primary forest and borders; 18-750 m.

Paratypes: Peninsular Malaysia: Selangor: Gunong Bunga Buah, *Whitmore FRI 337* (A, L); Ulu Gombak, *Stone 6892* (CANB); genting Simpah, *Poore 236* (CANB). Pahang: Genting Highlands, *Chung 1* (KLU). Negri Sembilan: Jelebu, *Everett KEP 104947* (A, L), Johore: Gunong Belumut, *Whitmore FRI 8771* (L); Kota Tinggi, Sungai Pelepah, *Corner SF 31433* (A, BO). Peninsular Malaysia without precise locality, *Herb. Maingay Kew Distrib. No. 277* pro parte (L).

*Melicope corneri* is most nearly related to *M. accedens*, differing mainly in its smaller anthers and seeds and its combination of usually smaller, glabrous, persistent petals and usually smaller fruiting carpels. The specific epithet commemorates Edred J. H. Corner.

#### 6. *Melicope accedens* (Blume) T. Hartley

Sandakan 4 (1994) 67. *Euodia accedens* Blume, *Bijdr.* (1825) 246. *Zanthoxylon accedens* (Blume)



Miq., Fl. Ned. Ind. 1(2) (1859) 671. *Ampacus accedens* (Blume) Kuntze, Revis. Gen. Pl. 1 (1891) 98. Type: Java, Blume (L, Lectotype, designated by Hartley, opp. cit.).

*Euodia pilulifera* King, J. Asiat. Soc. Bengal, pt. 2, Nat. Hist. 62 (1893) 210. Syntypes: Peninsular Malaysia: Perak: Larut, King's collector (Kunstler) 6275 (CAL, Holosyntype; L, US, Isosyntypes); without precise locality, *Scortechini* 360 (not seen), Wray 2995 (not seen).

Andaman Islands east to Vietnam and south to Java. In the Malayan Peninsula, known from Kedah, Perak, Trengganu, Selangor, Pahang, Malacca, and Johore; primary and secondary forest from near sea level to 1980 m.

*Melicope accedens* is most nearly related to *M. corneri* (q.v.). The specific epithet (from the Latin *accedo*, approaching or resembling) was most likely intended by Blume to refer to the relationship of the species to *Euodia macrophylla* Blume. The latter is now considered to be conspecific with *M. accedens* (Hartley, Sandakania 4 (1994) 67).

As Hartley noted in Sandakania 4 (1994) 69, two variants of *Melicope accedens* occur in Peninsular Malaysia. Plants described in that account as Variant A correspond with specimens centering around the type of *M. accedens*, whereas those described as Variant B corresponds with specimens centering around the type of *M. pilulifera*.

## 7. *Melicope hookeri* T. Hartley

Sandakania 4 (1994) 70. *Euodia robusta* Hook. f., Fl. Brit. Ind. 1 (1875) 488. *Ampacus robusta* (Hook.f.) Kuntze, Revis. Gen. Pl. 1 (1891) 98. Syntypes: Malayan Peninsula: Penang, Phillips (not seen); Singapore, Herb. Maingay Kew Distrib. No. 278 pro parte (GH, Lectotype, designated by Hartley, opp. cit.). A Leiden sheet with this Maingay number is *Melicope glabra*.

Peninsular Malaysia (Negri Sembilan: Berembun Forest Reserve), Singapore (Bukit Timah Forest Reserve), Sumatra, and Borneo; primary and secondary forest and borders; at lower altitudes throughout the range and ascending to 1600 m in Borneo.

*Melicope hookeri* is very closely related to *M. incana* T. Hartley, which occurs in east-central Sumatra, Borneo, and northern Celebes. The latter species differs mainly in its densely whitish-tomentose leaflet blades. From its trifoliolate congeners in the Malayan Peninsula, *M. hookeri* is readily distinguishable (with adequate magnification) by its mostly fasciculate or stellate trichomes.

## 8. *Melicope macrocarpa* (King) T. Hartley, comb. nov.

*Euodia macrocarpa* King, J. Asiat. Soc. Bengal, pt.2, Nat. Hist. 62 (1893) 209. Syntypes: Peninsular Malaysia: Perak: Larut, King's collector 7489 (L, Lectotype, here designated; US, Isolectotype); without precise locality, Wray 2618 (not seen), 3266 (not seen).

Tree 5-21 m high, trichomes mostly simple. Young branchlets like the petioles and inflorescences velutinous or minutely so or rarely sparsely puberulent, 5-8 mm wide in third internode; terminal bud velutinous or rarely appressed-pubescent. Leaves opposite, trifoliolate (occasional leaves unifoliolate), 18-43 cm long; petiole 4.5-16.5 (-20) cm long, 2-4 mm wide at middle; petiolule in lateral

leaflets 1-9 mm long, in terminal leaflet 2-12 mm long; leaflet blades subcoriaceous or coriaceous, sparsely puberulent to pubescent below, especially on midrib and main veins, puberulent on midrib or glabrous above, elliptic or narrowly so to obovate or in lateral leaflets sometimes narrowly ovate-elliptic, in terminal leaflet 11-32 x 5-15 cm, the base acute to subattenuate, the margin entire, the apex acuminate or abruptly so or sometimes rounded, the midrib plane or slightly impressed above, the main veins prominulous to slightly impressed above, in terminal leaflet 14-22 per side, divergent at angle of 60-75°, the veinlet reticulation prominulous or plane below or obscure. *Inflorescences* axillary, many-flowered, 7-14 x 3.5-13 cm, the peduncle 1-6 cm long, the main branches ascending, the pedicels 1.5-2 mm long (2.5-3 mm long in fruit). *Flowers* unisexual, plants dioecious; sepals nearly glabrous to puberulent abaxially, glabrous adaxially, connate at base or up to 1/4 their length, ovate, 0.6-1 mm long, persistent in fruit; petals white, narrowly imbricate, glabrous or rarely sparsely strigillose abaxially, glabrous or rarely in proximal 1/3-1/2 sericeous adaxially, ovate-elliptic, 2.7-3 mm long, deciduous in fruit; stamens 4, in ♂ flowers 4-4.5 mm long (1.5-2 mm long in ♀ flowers), the filament glabrous abaxially, sparsely pilosulose in proximal 1/4 adaxially, subulate to filiform at apex, the anther about 1.5 mm long (0.8-1 mm long in ♀ flowers); disc pubescent or villosulous; gynoecium in ♀ flowers about 2.5 mm long (about 1 mm long in ♂ flowers), the ovary pubescent, the carpels 2-ovulate, the style pubescent to pilosulose, including stigma about 1.5 mm long, the stigma capitate, weakly 4-lobed, about 0.6 mm wide. *Fruiting* carpels connate at base, divaricate, ellipsoid to obovoid, (7.5-) 10-11 mm long, the exocarp subfleshy, puberulent to velutinous, the endocarp pubescent, adnate, at least toward apex; seed attachment Type B, the funiculus 1.5-2.5 mm long, 0.5-0.6 mm wide at middle; *seeds* ovoid to ellipsoid or rarely subglobose, (4-) 5.5-7 mm long.

Peninsular Malaysia (Penang, Perak, Selangor, and Pahang) and northern Sumatra; primary and secondary forest; mostly at lower altitudes but ascending to 1500 m in Pahang.

From its congeners in the Malayan Peninsula, *Melicope macrocarpa* differs mainly in having indumentum on its endocarp and in the locules of its ovary.

#### 9. *Melicope pachyphylla* (King) T. Hartley, comb. nov.

*Euodia pachyphylla* King, J. Asiat. Soc. Bengal, pt. 2, Nat. Hist. 62 (1893) 210; Ann. Roy. Bot. Gard. (Calcutta) 9 (1901) 12, tab. 15. Syntypes: Peninsular Malaysia: Perak: Gunong Batu Puteh, Wray 229 (L, Lectotype, here designated); Gunong Babu, King's collector (Kunstler) 7432 (L, Isosyntype), Scortechini 732 (not seen), Wray 3835 (not seen). Pahang: Gunong Berumbun, Wray 1571 (UC, Isosyntype).

Shrub or tree 1.2-4.5 m high, trichomes mostly simple. Young branchlets like the terminal bud, petioles, and inflorescences pubescent to velutinous, 3-5.5 mm wide in third internode. *Leaves* opposite, trifoliolate, 6-25 cm long; petiole 2-11 cm long, 1.5-3 mm wide at middle; petiolules 1.5-15 mm long; leaflet blades

subcoriaceous or coriaceous, puberulent or pubescent on midrib below and, toward base, on midrib above and margin, otherwise glabrous or nearly so, elliptic to obovate, in terminal leaflet 4-12.5 x 2-5.5 cm, the base acute to attenuate or in lateral leaflets obtuse, the margin entire, the apex rounded or emarginate to short-acuminate, the midrib impressed above, the main veins prominulous above, in terminal leaflet 9-13 (-17) per side, divergent at angle of 70-75°, the veinlet reticulation obscure. *Inflorescences* axillary, several- or many-flowered, 3-9 x 2-3.5 cm, the peduncle (0.35-) 1.5-6 cm long, the main branches ascending, the pedicels 1-3 mm long (3-4 mm long in fruit). *Flowers* unisexual, plants dioecious; sepals pubescent to velutinous abaxially, glabrous adaxially, connate at base, ovate or ovate-triangular, (1-) 1.5-2 mm long, persistent in fruit; petals white or cream, narrowly imbricate, rather fleshy, appressed-pubescent abaxially, sericeous-pubescent adaxially, ovate-elliptic, (2.5-) 3.3-4 mm long, deciduous in fruit; stamens 4, about 3 mm long, the filament glabrous abaxially, sparsely pilosulose in proximal 1/6-1/3 adaxially, narrowly obtuse or sometimes acute at apex, the anther in ♂ flowers 1.5-1.7 mm long (0.7-0.8 mm long in ♀ flowers); disc glabrous; gynoecium in ♀ flowers 1.2-2.5 mm long (about 0.6 mm long in ♂ flowers), the ovary and style pubescent, the carpels 2-ovulate, the style including stigma 0.6-1.5 mm long, the stigma clavate or rarely capitate and weakly 4-lobed, 0.3-0.4 mm wide. *Fruiting carpels* connate at base, divaricate, ellipsoid, 8-10 mm long, the exocarp dry, puberulent or glabrate, the endocarp glabrous, adnate, at least toward apex; seed attachment Type B, the funiculus about 1 mm long, about 1 mm wide at middle; *seeds* subglobose or ellipsoid, 4.5-5 mm long.

Endemic to Peninsular Malaysia, where known from Perak and Pahang; forest and open ridges, 1350-2000 m.

From its trifoliolate congeners in the Malayan Peninsula, *Melicope pachyphylla* is distinguishable mainly by its petals, which are rather fleshy, appressed-pubescent abaxially, sericeous-pubescent adaxially, and comparatively large; by its stigma, which is usually clavate; by its fruiting carpels, which are comparatively large and have glabrous endocarp; and by its leaflet blades, in which the indumentum is mostly restricted to the midrib and margin.

#### 10. *Melicope pahangensis* T. Hartley, nom. nov.

*Euodia simplicifolia* Ridl., J. Linn. Soc., Bot. 38 (1908) 306. Type: Peninsular Malaysia: Pahang: Gunong Tahan, Wray & Robinson 5492 (BM, Holotype; SING, Isotype). The specific epithet *simplicifolia* is pre-empted in *Melicope*.

Shrub about 2 m high, trichomes simple. Young branchlets like the petioles nearly glabrous to puberulent and ± glaucous, 2.5-3.5 mm wide in third internode; terminal bud sparsely puberulent to appressed-pubescent. *Leaves* opposite, unifoliolate (rarely occasional leaves bifoliolate), 6-11.5 cm long; petiole 1-2 cm long, 1-1.5 mm wide at middle; petiolule obsolete; leaflet blade subcoriaceous or



coriaceous, glabrous, ovate to elliptic, 5-10 x 2.5-4.5 cm, the base rounded to acute, the margin entire, the apex acute to acuminate, the midrib prominulous or plane above, the main veins prominulous above, 8-11 per side, divergent at angle of 60-70°, the veinlet reticulation prominulous or  $\pm$  obscure. *Inflorescences* axillary, puberulent, several-flowered, 2-2.5 x 0.8-1 cm, the peduncle 1-1.8 cm long, the main branches ascending, the pedicels 1.5-2.5 mm long (1.5-3.5 mm long in fruit). *Flowers* unisexual (only ♀ seen), plants probably dioecious; sepals sparsely puberulent abaxially, glabrous adaxially, connate at base, ovate-triangular, 0.7-0.8 mm long, persistent in fruit; petals (colour unknown) narrowly imbricate, glabrous abaxially, sparsely and minutely puberulent in proximal 1/3 adaxially, ovate-elliptic, about 2 mm long, deciduous in fruit; stamens 4, infertile, 0.6-0.8 mm long, the filament glabrous, acute at apex, the anther 0.3-0.5 mm long; disc pubescent; gynoecium 2-2.5 mm long, the ovary pubescent, the carpels 2-ovulate, the style pubescent in proximal 1/3, including stigma 1.5-2 mm long, the stigma capitate, weakly 4-lobed, 0.5-0.6 mm wide. *Fruiting carpels* connate at base, ascending, ellipsoid, 6.5-8.5 mm long, the exocarp dry, puberulent or glabrate, the endocarp glabrous, adnate, at least toward apex; seed attachment Type B, the funiculus about 0.4 mm long, about 0.6 mm wide at middle; *seeds* subglobose to ellipsoid, 4.5-5 mm long.

Endemic to Peninsular Malaysia, where known only from Pahang (Gunong Tahan and Gunong Brinchang); forest from 1500-2100 m.

From its congeners in the Malayan Peninsula, *Melicope pahangensis* differs mainly in its combination of unifoliolate leaves, 4-staminate flowers, adnate endocarp, and Type B seed attachment.

### Excluded species

In his treatment of *Euodia* in Tree Fl. Malaya 1 (1972) 376-379, Stone included two species that are now believed not to occur in the Malayan Peninsula, namely, *E. latifolia* DC. and *E. euneura* (Miq.) Miq. The former, which has been transferred to *Melicope* (Hartley, Sandakania 4 (1994) 72), ranges from Java northward to Borneo and the Philippines and eastward to Samoa. It is superficially similar to *M. accedens* and *M. corneri*, with which Stone apparently confused it. The latter, which is to be transferred to *Melicope*, is believed to be endemic to southern Sumatra. Stone apparently confused it with pubescent-leaved plants of *M. macrocarpa*, which is one of its close relative, although his description of the fruit fits neither species.

### Index to numbered collections of *Melicope* from the Malayan Peninsula



The numbers in parentheses refer to the corresponding species in the text.

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### *Tetractomia* Hook.f.

This genus has been revised by Hartley (J. Arnold Arb. 60 (1979) 127) with *Terminthodia* Ridley being reduced to synonymy under it. The species *Terminthodia viridiflora* Ridley, previously accepted in the Tree Flora account (p. 385) has also been reduced to a synonym of *Tetractomia tetrandrum* (Roxb.) Craib. Hartley recognizes three forms in the Malayan Peninsula, the "generalized

form," the "Malayan mountain race," and the "peat swamp race." He regards *Terminthodia* as a representative of the Malayan mountain race, in which he also includes *Tetractomia holtumii* (already synonymized in the Tree Flora account.) Hartley states that "a complete range of intermediates between the generalized form and the Malayan mountain race exists in Malayan forests between 900 and 1400 m altitude, and it is evident that the latter is merely a high mountain extreme of the former. The peat swamp race is reasonably distinct from the generalized form in the Malay Peninsula in having inflorescences shorter than the subtending leaves and a tendency toward smaller petals and follicles." *Tetractomia majus* is upheld as a distinct species. The account of *Tetractomia* therefore remains as originally published except for the inclusion of *Terminthodia*, and the reduction of *Terminthodia viridiflora* to the synonymy of *Tetractomia tetrandrum*.

It may be emphasized that the gender of the name *Tetractomia* is neuter, not feminine. The name *T. majus* is correct but deceptive, as the epithet is the comparative form of the adjective for large, i.e. equivalent to 'larger'.

### **Tetradium** Lour.

Loureiro, Fl. Cochinch. (1790) 91; not of Dulac, 1867. HARTLEY Gard. Bull, Sing. 34 (1981) 91.

Gr. *tetradion*, quaternion, referring to the 4-merous flowers and fruit of *Tetradium trichotomum* Lour.

Trees or shrubs, usually dioecious, deciduous or evergreen. Indument of simple hairs. *Leaves* opposite, pinnate, mostly with a terminal leaflet, the lateral leaflets usually stalked, their blades usually oil-dotted. *Inflorescences* corymbose to occasionally paniculate, terminal or both terminal and in the upper axils. *Flowers* unisexual (but rarely bisexual), 4-5-merous, with valvate, persistent sepals; petals narrowly imbricate in bud, deciduous; stamens opposite the sepals, longer than the petals in staminate flowers; filaments usually villous up to the middle, anthers ovoid, dorsifixed; stamens rudimentary or obsolete in pistillate flowers. Intrastaminal disc present. Gynoecium in pistillate flowers about as long as the petals, carpels free or connate at base, forming a lobed to subglobose or obovoid ovary; carpels 2- (or 1-) ovulate; style apical with peltate 4-5-lobed stigma, Carpels in staminate flowers rudimentary, fingerlike. *Fruit* follicular, the follicles 1-2-seeded, dehiscent adaxially, apically and partly down the abaxial surface; endocarp cartilaginous, persistent. *Seeds* dark brown to glossy black, smooth, retained within the follicle; endosperm fleshy; embryo straight; cotyledons plano-convex; hypocotyl terminal.

A genus of 9 species of India, Indochina, China, Korea, Japan and the Ryukyu Islands, W.Malesia including the Philippines and Sumatra, but not in Borneo. Most of the species had originally or subsequently been placed in *Euodia* and there is a general resemblance. Two species in Peninsular Malaysia; both very rare and only in the northern region.

## Key to the Peninsular Malaysian species of *Tetradium*

1. Follicles 2-seeded though often seemingly 1-seeded; flowers 4-merous; leaflets greenish, hairy ..... *Tetradium sambucinum*
1. Follicles 1-seeded; flowers 5-merous; leaflets glabrous or slightly pubescent, usually glaucous beneath... *Tetradium glabrifolium*

### ***Tetradium sambucinum* (Bl.) Hartley**

(Like *Sambucus*, Caprifoliaceae)

Gard. Bull. Sing. 34 (1981) 100. *Philagonia sambucina* Bl. Cat. Pl. Buitenz. (1823) 21; Bijdr. (1825) 250. *Euodia sambucina* (Bl.) Hook.f. ex Koord. & Val. Med. Lands Plantent. 17 (1896) 216.

Medium to large tree to 34 m tall, branchlets puberulent but glabrate. *Leaves* to 36 cm long; of 3-6 pairs of leaflets; stalks of lateral leaflets to 10 mm long; blades elliptic-oblong to ovate, lanceolate, or oblanceolate, 6-18 cm long, 2-5 cm wide, at base usually somewhat oblique (except in terminal leaflet), with 13-16 pairs of main secondary veins, the margins crenulate distally, the apex acuminate; conspicuously gland-dotted, drying pale green or brownish, usually with appressed pubescence on midrib and main veins. *Inflorescences* to 25 cm long, the axes slightly pubescent, pedicels less than 1.5 mm long. *Flowers* 4-merous, petals yellow-green drying brownish, to 3 mm long, somewhat villous inside. *Fruit* of 4 follicles, each 3-4 mm long and high, free to base or nearly so; endocarp sparsely pubescent; *seeds* 2 per follicle, coherent (like a single one), 1.5-2 mm long.

W. Malaysia, Sumatra, Java, and Sumbawa. In Peninsular Malaysia, known only in Trengganu, G. Andi Mangin (Whitmore *FRI* 12139).

### ***Tetradium glabrifolium* (Champ. ex Benth.) Hartley**

(glabrous leaved)

Gard. Bull. Sing. 34 (1981) 109. *Boymia glabrifolia* Champ. ex Benth. in Hook. J. Bot. Kew Gard. Misc. 3 (1851) 330. *Megabotrya meliaefolia* Hance ex Walp. Ann. Bot. Syst. 2 (1852) 259. *Evodia meliaefolia* (Hance ex Walp.) Benth. Fl. Hongkong (1861) 58. *Phellodendron burkillii* Steenis, Gard. Bull. Sing. 17 (1960) 357.

Small or medium tree to 20 m tall, branchlets finely pubescent but fully glabrate. *Leaves* to 38 cm long, with 2-9 (rarely but 1) pairs of leaflets, the blades elliptic to oblong-elliptic, 4-15 cm long, 1.7-6 cm wide, the lateral ones acute to subtruncate at base, usually oblique, the apex acuminate, the margins entire to crenulate, with 8-18 pairs of secondary veins, gland-dots inconspicuous, undersurface whitish or pale green and usually distinctly glaucous; lateral leaflet stalks 3-15 mm long. *Inflorescences* to 19 cm long, the axes finely pubescent to glabrous, pedicels to 4 mm long. *Flowers* mostly 5-merous; petals greenish to yellowish or white, to 4 mm long. *Fruit* usually 5-carpellate, all or only 1-4 carpels maturing as follicles, these puberulent on the sides, 1-seeded. *Seed* black, subglobose or ovoid, 2.5-4 mm long, usually paired with a smaller aborted seed.

NE India and Sikkim Himalaya to S China and Indochina, N to Japan, Taiwan, S to Peninsular Malaysia, Sumatra, and NE to the Philippines.

In Peninsular Malaysia, known from Kedah (Enggang Forest Reserve, . KEP 78904, type of "*Phellodendron burkillii*") and Gunung Jerai (Kedah Peak, FRI 021715); recorded as a tree to 16 m (50 ft.) tall with smooth slightly lenticellate bark. Rare.